ABSTRACT

The present invention provides a practical design of a megavoltage x-ray detector with both high quantum efficiency (QE) and high resolution. The x-ray detector disclosed herein has a QE that can be an order of magnitude higher than that of current flat panel systems and yet has a spatial resolution equivalent to that of current flat panel systems used for portal imaging. The x-ray detector includes a large number of micro-structured electrically conducting plates, packed together with thin spacers placed between neighboring plates with the micro-structured plates oriented to be parallel to the incident x-rays in operation. Each plate includes an electrically conductive substrate with a first planar surface, elongate electrically conductive strip electrodes separated from each other with strip spacers placed in between and sitting on an insulating layer interposed between the first planar surface of the electrically conductive substrate and the strip electrodes. A power supply applies a bias voltage between each electrically conductive substrate and the electrically conductive strip electrodes, whereby x-rays absorbed in the conductive substrate generates high energy electrons which produce ions in an ionization medium located in spaces between the conductive substrate and the electrically conductive strips. A detector detects an electrical current generated in the electrically conductive strip electrodes and a 2D active readout matrix is coupled to the detector.